DOCUMENT RESUME

ED 229 265 SE 041 547

AUTHOR Gearhart, Maryl
TITLE Divanap Community School Field Report. Indigenous Mathematics Project. Working Paper 8.
INSTITUTION Indigenous Mathematics Project, Port Moresby (Papua New Guinea).
SPONS AGENCY Papua New Guinea, Dept. of Education, Port Moresby.; United Nations Educational, Scientific, and Cultural Organization, Paris (France).
PUB DATE Nov 80
NOTE 40p.; For related documents, see SE 041 540-555.
PUB TYPE Reports - Descriptive (141) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Cross Cultural Studies; Cultural Influences; *Curriculum Development; Educational Research; Elementary Education; *Elementary School Mathematics; Ethnography; *Field Studies; Language Role; Mathematical Vocabulary; *Mathematics Curriculum; *Mathematics Instruction; Teaching Methods; Textbooks; Workbooks
IDENTIFIERS *Indigenous Mathematics Project; Mathematics Education Research; *Papua New Guinea

ABSTRACT

This report summarizes field work in Divanap, Papua New Guinea, one of five community schools participating in the ongoing research and development efforts of the Indigenous Mathematics Project (IMP). The site is described, with detailed comments on the school and the community. Background on the teacher is provided. Sizes of the two grade 2, one grade 4, and one grade 6 classes participating in the study are given. Curriculum implementation is then discussed, with note of such problems as the teacher's frequent inability to understand the teacher's notes, and learning aids are given. Classroom interaction is described, noting that instruction was usually in English; and that classes were teacher-directed, with little group work. Two interviews with students are briefly noted. The study concludes that, in general, the IMP materials were not uniformly successful at this site. Among the suggestions offered is that, for an isolated site such as Divanap, IMP should include suggestions of activities for which application of new mathematical skills is encouraged. (MNS)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED229265

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

✓ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Randall Souviney

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

INDIGENOUS MATHEMATICS PROJECT

SE041547

DIVANAP COMMUNITY SCHOOL FIELD REPORT

Maryl Gearhart

Working Paper 8
November 1980

THE INDIGENOUS MATHEMATICS PROJECT

This series of working papers and research reports has been published to provide a comprehensive source of documentation on research and development efforts associated with the Indigenous Mathematics Project. The Project was established in 1977 by the Government of Papua New Guinea to investigate various aspects of traditional mathematics development. During the first phase (1977–79) of the five year program, basic research in crosscultural cognitive development was carried out and indigenous counting, classification and measurement systems used throughout the country were documented. During the second phase of the project (jointly funded by the Department of Education and UNESCO), pilot instructional materials were developed and trialled. The intent was to assess the feasibility of utilizing complementary aspects of indigenous and Western mathematics as a basis for developing culturally relevant student materials, instructional aids and teachers' guides which reflect the practical constraints of the community school environment. The results of IMP work are intended to inform future curriculum development in an effort to provide more appropriate instructional materials and learning aids for Community Schools throughout Papua New Guinea.

Series Editor: Randall Souviney
Managing Editor: Jacquie Wathen

INDIGENOUS MATHEMATICS PROJECT

Field Report

DIVANAP COMMUNITY SCHOOL
WEST SEPIK PROVINCE

14 July - 22 August 1980

by

Maryl Gearhart*
School of Language and Communication
Hampshire College
Amherst, Massachusetts

*Ethnography contributed by Thomas Moylan, CUNY, New York. This report summarizes field work carried out in Papau New Guinea at one of five community schools participating in the ongoing research and development efforts of the Indigenous Mathematics Project.

INTRODUCTION

Transportation

For persons coming to Divanap from a distance (e.g. teachers, missionaries, men returning from plantations, etc.), most fly by single engined aircraft either to Oksapmin or to Tekin and then walk. Oksapmin has a government station and is a four hour walk to Divanap; Tekin has a Baptist Mission and is a two hour walk to Divanap. There are a few motor bikes at Oksapmin (belonging to Kiaps) and at Tekin (belonging to missionaries), but these can be more a source of frustration than assistance since the motor bikes get stuck in wet, muddy stretches of the road. The road varies from tractor width at Oksapmin and Tekin to foot path at Divanap. The community maintains the road by chopping encroaching grass and bush and by laying logs and stones in the most muddy stretches.

Environs

Divanap is situated in the highlands of West Sepik Province along the Tekin river at an elevation of 2000 metres. The weather is typically cool and moist with substantial rainfall in the rainy season and some warm, dry, sunny days in the dry season. The valley is narrow, and valley walls are steep. The river is fairly small, fast-moving, and frequently shallow enough to wade across. The flora are tropical highlands forest. The soil is not well suited to gardening as it has a very high clay content and is thin due to heavy rains and steep and rocky bedrock. Gardens are slash-and-burn type, and there is a fallow period of 3 to 10 years. Much land in the valley either is a garden or is a garden lying fallow. The fauna in the valley are sparse: in the

rivers, tadpoles but almost no fish; in the forest, frogs, occasional birds, lizards, snakes, kuskus, rats, mice, insects. The valley is dotted with tiny hamlets of 4 to 20 houses, many invisible from the road. Houses are small (about 8' x 10'), of bush materials, on poles, built around a central fire pit.

Housing and Supplies

Teachers' houses are a modified coastal design made of bush materials, with the exception of the headmaster's house, which, though incomplete, is constructed of permanent materials with a water tank. Our house was about 12' x 16' constructed about 3 feet above the ground of strong poles, grass roof, woven pitpit matting for walls, bark floors. Next to the house was a small 'cookhouse' or 'kitchen' with pitpit matting for walls, grass roof, centre fireplace. Both our house and cookhouse were weather-beaten, worn and in need of attention, in considerably worse shape than either of the other 2 bush material teachers' houses currently occupied by teachers. (There was another teacher's house in very poor condition not in use by anyone.) Our house was made by former students in the school. The pitpit matting was very loosely and poorly woven (the cold wind blew through); the roof leaked in heavy rains; the bark floor was weak in a number of places and a potential hazard. We had 2 'windows,' essentially pitpit shutters that could be propped open with a stick under the grass roof. The school provided us with a table, 2 benches, a metal cabinet. They had constructed 3 separate bedrooms (6' x 6') on the periphery of the main room (about 6' x 8') and the hallway (about 2½' x 10'). Students helped us make minor modifications in their design. We built bush shelves as well. We provided our own kerosene stoves and lanterns. We were provided our own out-house about 15 yards from the house, well constructed, with carefully made steps out to it over a stream. We constructed a shower-stall and clothesline with the help of teachers and students. Our

rubbish was thrown over a nearby school fence, much to the delight of the local pigs. We were well supplied with food, because Tom Moylan knew to order food from BP's at Wewak, and the missionaries at Tekin were willing to sell us food in addition to that available at the trade store. Also the teachers had previously organized a vegetable market at the school 3 days a week, and we were able to buy a wide variety of vegetables there. Thus we had rice, vegetables, cheese, meat, chicken, eggs, spaghetti, flour, sugar, dried milk, instant coffee, biscuits, cereals, etc. We were much better supplied than I expected or needed. Once a week we sent a carrier down to Tekin mission to buy kerosene and food from the trade store and the mission store and to pick up any mail and any food order from Wewak.

Initial Reactions

The school was physically much more attractive and cared for than I expected. With its flower gardens, stone-covered assembly field and paths, the grounds surrounding the bush classrooms were a striking contrast to the rather casual organization of tiny hamlets we passed on the road coming up. However, I became quickly dismayed (as reflected in my General Notes) at the amount of outdoor work engaged in by the students on the school; we had arrived in the 9th week of term 2, and weeks 9 and 10 were overwhelmingly devoted to student outdoor work. I was further bewildered by the headmaster's assertion, when we arrived, that this (week 9) was the last week of the term (and thus, he explained, devoted to outdoor work). One teacher had in fact already left. On Monday of week 10, I became further confused when the garamut was sounded and students arrived. The headmaster acknowledged he had made an error in his interpretation of the calendar. Then, that same day the school inspector arrived, several days late (he was to have come during week 9). It is not clear how to interpret this odd sequence of events. That week, 10th week of

term 2, the headmaster left on Wednesday; on Thursday the teacher who had been away returned; on Friday 2 more teachers left. During week 1 of term 3, the 2 teachers who had left returned late in the week, and the headmaster did not return until toward the end of week 2. Thus these comings and goings of teachers, their bizarre misreading of the school calendar for term 2, and excessive student outdoor work all contributed to an initial impression of staff irresponsibility and unconcern for education. My impressions during term 3, however, were more favourable.

SCHOOL SETTING

School Design and Construction

The school consists of 5 classrooms, 1 office, 5 teachers' houses. All are made from bush materials, with the exception of the headmaster's house which is made of permanent materials (though it is not complete) with a water tank for use by all teachers. The grounds lie near the river in this steep valley, and much work has been done over the years to create reasonably flat dry grounds. Trenches are dug and maintained around all the buildings; much effort was spent while we were there in digging and leveling the soccer field and basketball court. Between buildings there are paths of stones and flower gardens. There are teachers' and school vegetable gardens. The classrooms lie on either side of the school office and the assembly area, and the teachers' houses on the periphery of classrooms. Classrooms are constructed of bush materials with dirt (clay) floors. Most classrooms are lit only by light from the door and from gaps between grass roof and the pitpit matting walls. The classrooms are thus dark, and they can be cold. The rooves on many leak in heavy rains, and if there is a good wind, it can sweep even light rain through the doors and light spaces across the childrens' desks and teachers'

wall displays. All classrooms have multi-student desks in poor condition.

History of Schooling (T. Moylan, with M. Gearhart)

The first school in the area opened at Telefomin about 1962. The first few students walked to Telefomin, 3 to 4 days from the nearest Oksapmin hamlets, and boarded at the Baptist Mission there. Of this group 3 went on to higher education and are now employed outside the province. A few others returned, some after only a few years schooling, but they quickly found employment with the Tekin mission and the government in the early, hectic days when they were trying to extend their influence through the area. In 1967 a school opened at Tekin (two hours away), and in 1969 another opened at Oksapmin (four hours away), but only a few children from the Divanap area went there.

The Divanap school opened in July, 1973, with 48 students and a single headmaster. The school was built with local materials, with nails and water tank supplied by the government. Major work was paid for out of RIP funds. Even by 1974 it was difficult to get parents to work on the school voluntarily, and today much work is done by the school children; perhaps 5-10 adults show up each week to help with heavy construction. There are now 2 grade ones awaiting construction of a new classroom delayed by lack of parental support and by teacher turnover.

Since the opening of the school, one permanent materials teacher's house has been built, and two others have sheet zinc roofing; materials and labour were supplied by RIP funds. Conditions are poor, and, with the exception of an American teacher (1974-75) and Mr and Mrs Kouye (1978-79), no teacher has spent more than 1 year at the school.

Yearly enrollment at Divanap peaked in 1975 and has remained lower but fairly stable since then. Ages in grade 1 have ranged from 7 to about 14. Boys enroll and remain in school at markedly higher rates than girls (3:1 -

3:2), in part because parents fear their daughters will go to high school elsewhere, marry elsewhere, and parents might lose the bride-price. Drop-out rates are high for all (29-44%), but especially high for girls (as high as 50%). Similarly, the number of students not attending school in the Divanap area is high--roughly 50% for all children with perhaps 67% of Divanap girls not in school.

There has been ongoing strain in relations between teachers and community. None of the teachers has been Oksapmin, and yearly turnover makes it evident that teachers are not inclined to involve themselves with Oksapmin culture. Teachers resent lack of parental support, and parents resent that their children are made to work in their stead. The teachers are further frustrated by the meagre school budget and the inability of parents to afford more than K1.50 per annum per child (which some parents cannot afford at that). At present, there is evidence that some teachers--following their own experience as students--sometimes use intimidation and/or punishment (some of it mild corporal punishment), which frightens the children and is at odds with traditional child-rearing techniques (see Community Ethnography). Some teachers also use school time to walk to Tekin or Oksapmin for mail, supplies, and food and take long breaks to visit their homes. While the extreme isolation of Divanap justified some of this license, these teachers' behavior bespeaks of their unhappiness and less than needed commitment to Divanap school children.

The record, then, shows low to moderate enrollment, high drop-out rates, not much voluntary work done by parents, poor facilities, almost 100% yearly teacher turnover, and strains between community and teachers. It is not a promising picture. However, the school does have some support from the community, and many parents and students recognize it as virtually the only

avenue through which the area can begin to join the larger highlands community.

Curriculum Materials

Books and teachers' guides available seemed to be just the minimum required: for each grade, Using English, Let's Speak English, Minenda Readers, Pacific Series Readers. Teachers had (in addition to the Teacher's Guides for the above) for at least some grades, guides for MaCS, Primary Science, Health Education for Primary Schools, Social Studies, English syllabi, Community School syllabi, Community Life syllabi, Physical Education syllabi, Basic Science, English Radio magazine, Stori Bilong ol Pikinini, etc. In the storeroom there were only a few extras: PNG Independence 1975, Orokaiva readers, Our News, New Nation, science supplies (mirrors, burners, funnels, syringes, rubber hose, light sockets, weighing stands, etc.). There were a small variety of commercial maps, science charts and diagrams, language and reading aids.

There were, it seemed, sufficient supplies of exercise books, chalk, glue packets; pencils were a bit short; scissors and individual chalk-boards were indeed scarce, but teachers managed to circulate them among classrooms. There was a variety of art materials (attractive coloured papers, plasticine, coloured chalks, crayons, paints)--and the always available Oksapmin clay.

Equipment

There was no duplicator or typewriter. Radios were available at the school. (I'm not sure whether any radio belongs to the school or all radios are personal.)

Daily Time Schedule for School

Time	Description
8:30 - 8.15	Assembly (Monday and Wednesday, outdoors; Tuesday, Thursday, Friday, inside.
8:15 - 10:00	Classroom Instruction
10:00 - 10:30	Morning Recess
10:30 - 12:00	Classroom Instruction
12:00 - 1:00	Lunch
1:00 - 3:30	Classroom Instruction
2:30 - 3:30	Agriculture (Monday); Community Activities (Wednesday); Cultural Activities (Thursday).
1:00 - 1:30	Religious Instruction (Tuesday and Friday)

Summary and Comments on School Setting

Divanap is a community school located in the Tekin valley in the relatively remote Oksapmin area of West Sepik Province. The school was opened mid-year in 1973 and is constructed largely from bush materials. Facilities are generally poor. Classrooms and teachers' houses are dark and often cold and damp. There is yearly teacher turnover. The school does not receive much community support. Attendance is fairly low and drop-out rates are fairly high. Age ranges of students in each grade is large. There is low enrollment for girls. Currently there are 5 classrooms and 5 teachers for two grade 2s, a grade 3, grade 4, and grade 6. There would have been a grade 1 this year, but the community did not rally/was not rallied sufficiently to build a new

classroom. Despite all these problems there is evidence that the school has importance for a reasonable proportion of the community.

COMMUNITY SETTING

Overview (T. Moylan)

Approximately 6 'villages' (determined by government rest houses) (Divanap, Tomianap, Tekap, Kwipa, Daburap, Bok) are serviced by the school. Children's walk to the school ranges from 10 minutes to 2 hours. Many children walk at least a half hour; children who live more than an hour's walk away often sleep with local relatives during the school week. The main population served, located in the upper Tekin valley, is about 1800 censused at Tomianap, Divanap and Tekap. There are no true villages in the Oksapmin area. The residence pattern ranges from homestead consisting of a single house to large hamlets with approximately 20 houses.

Almost everyone gardens using slash-and-burn techniques. They grow primarily kaukau and taro, though the didimen have been introducing a wide variety of vegetables and peanuts and soybeans, both for local consumption and for sale to the Tekin mission vegetable market (2 hours walk) and their own co-operative vegetable market at Oksapmin (4 hour walk). There are a growing number of relatively progressive men and women growing chillies, green peppers, corn, carrots, scallions, cucumbers, cabbage, assorted greens, tomatoes and some coffee. About 70% of people have or look after a few pigs. Pigs forage for themselves in the daytime and are fed by owners at night; they sleep in the house with the caretakers at night.

Local houses are built on strong poles, about 10' x 10', with a central firepit. Walls and floors are usually sticks of somewhat irregular length covered with bark; rooves are traditionally pandanas leaves, but as these are

now in short supply, some now use pitpit. Houses are rebuilt, generally with the same materials, every 2-3 years. Houses are used for cooking, eating and for sleeping and are now, under mission influence, generally occupied by a nuclear family or, in the case of men with two wives, a woman and her children. (Pigs have one side allotted to them as a sleeping place.)

The climate in the dry season is cool at night and only if the sun is out does it become warm in the day; even in the dry season it rains a great deal. During the wet season the daily temperature range is small; it is continually quite cool. The rain causes continual soil erosion; footpaths are often very muddy and difficult.

Hamlets typically joined together in pre-contact times to form parishes of 250-300 persons. These were the war-making units which rallied together to fight other similar groups. Within each parish some degree of social control was maintained where the most serious incidents were settled by stick fights only. A parish usually controls a territory of about 15 square kilometres, which includes a portion of bottom land on the Tekin river (1700 m.a.s.l.) and all the territory extending up the mountain slopes to the peaks (2300 m.a.s.l.). Traditional leadership was dispersed among a number of specialists and relatively powerful figures. The local term for "headman" is borrowed from Telefol where it meant trader, a rich man. In the early period of contact these men were sought out by the government because of their wide knowledge of other groups and because they tended to be bilingual in the Telefol language which was spoken at the government station in Telefomin. At present the Oksapmin area is administered through a system of appointed village officials, the luluais and tultuls, who report to the Assistant District Officer, the kiap, at Oksapmin station. The village officials are principally concerned with maintaining law and order, by bringing miscreants

to the station for a hearing or settling small disputes at the local level. They are also responsible for recruiting labour for repair work on the self-help road scheme and for implementing government directives such as maintaining latrines. Local government councils are soon to be established in the area and elections for the provincial assembly have attracted some interest, but Oksapmin will have to pass through a painful period of trial and error before a political awareness develops.

There is a growing western influence on Oksapmin culture. Money has filtered through the area since contact times, and growing numbers of people handle small amounts. School children and men when they are away at plantation are required to wear western dress, and more and more people wear at least one article of (used) western clothing (shorts, shirt, skirt, or blouse). Many people prize western articles including axes, razor blades and soap. Pidgin is used in the area but generally only when necessary, and many people do not speak Pidgin at all.

Approximately 50% of children attend school at any one time; fewer girls attend school (perhaps 33%) than boys.

Language Use in the Community (T. Moylan)

The local vernacular is the Oksapmin language. Other language groups are within a day's walk, but there is little bilingualism in the area. Knowledge of Pidgin English is frequent but not universal among men aged 25-30. Pidgin is learned during casual labour at Oksapmin station, at the local bible school, or at the plantation. Only a few women have learned Pidgin at bible school or in nurses' training. Of the adult population as a whole, about 15% of the men and 5% of the women speak Pidgin. School children learn both Pidgin and English in school but have little opportunity outside of school, and few can converse. Less than 10 local adults in the whole area can speak any English.

Traditional Education and Socialization Processes (T. Moylan)

Children are loved and indulged. Babies are nursed until 2 or 3 years old, and babies and young children are commonly carried on the back or shoulders. Until the age of 8 or 10 children will mostly play in gardens or near their house. Older female children are left in charge of younger children, while older boys in groups of 2 or 3 will hunt for small game in garden areas near the houses. It is not until the time that teenagers approach marriageable age (16-18 for girls, 18-22 for boys) that they begin to engage in productive adult activities, but a young couple may not be fully independent until they have a second child.

Children are not believed to learn impulse control but rather they mature and acquire adult habits naturally. Children are not believed to become full persons until the middle teenage years. Children either have "good thoughts" or "bad thoughts." It is not expected that training will change their attitudes. Formerly infractions of dangerous taboos would have been punished with a violent thrashing or worse. Today only extreme cases of bad behaviour such as outright theft of food might merit a beating or temporary banishment from the house; a young child will respond to banishment with sobbing, and parents will quickly pacify the child.

Young people are expected to learn appropriate adult skills by observation and through casual instruction given by parents or elder siblings. More specialized processes like arrow carving or net bag manufacture might be learned from proficient relatives. Traditional curers or diviners used to take as apprentices young men who had experienced a supernatural episode, a seizure, indicating readiness. A 20 to 20 year cycle of male initiation was the most institutionalized learning activity in traditional culture. The last was carried out in the 1960's with the next due in 1982. The principal feature was a series of painful experiences such as suffering cold,

being exposed to rain, hunger or thirst. At each stage a part of a system of traditional knowledge, kept secret from women and children, is revealed to the initiates. These include fire making, the use of cult objects, reciting secret chants or making ritual offerings. The general purpose of the initiations was to pass on the skills required to manipulate the supernatural world which supported the normal functioning of the community and insured the food supply. There was no comparable set of instructions for women.

Community Life - School Performance

The following "factors" of community life may affect school performance. These are only impressions and intuitions and should be considered with scepticism.

Those factors which might contribute to productive and successful school performance are: familiarity with the diligent hard work required by subsistence gardening and bilum making in this area; a generally positive experience with local missionaries, kiaps, and didimen; a recognition by a reasonable number of the community that schooling will provide more and more residents of the area with knowledge and skills needed for economic growth (money and certain western material goods are desired); general lack of warfare and conflict among peoples in the area; respect and affection for parents and older relatives. Those factors which might contribute to unsuccessful school performance are: lack of an indigenous literacy; low rate of Pidgin use and Pidgin literacy; a concrete body-part counting system with no base and infrequent indigenous application (at least for western-like arithmetical algorithms); relative unfamiliarity with currency; lack of everyday uses for western knowledge acquired in school; lack of local jobs for grade 6 leavers who are not admitted to high school; for grade 6 leavers who are admitted to high school, its high cost; few models in the community of local people who

are currently profiting from recent schooling; yearly teacher turnover; poor school facilities; for girls, parental discouragement or prohibition; borderline malnutrition for some students.

IMPLEMENTATION STUDY

Teacher's History

J.U. is from Green River in West Sepik Province. He was schooled in a mission high school to grade 8, studied one year of art at Goroka Technical College, then 2 years at St. Benedict's Teachers College in Wewak. He had 6 years of teaching in bush schools near his home in West Sepik, Green River. This new position as a tenured senior teacher at Divanap represents an advance for him and was probably one source of motivation for his leaving the Sepik. However, his stated main reason for leaving was to escape wantoks who were draining any savings. J. U. has ambitions in the teaching profession--hopes for a position as assistant headmaster, then headmaster. He also intends to retire after about 20 years and open an art business on the Sepik, and he is continuing correspondence courses in vocational art to permit him the possibility of such a career shift. He would like to be able to hire grade 6 and grade 10 leavers in such a business. In general he expresses concern about the appropriateness of community school primary education for most leavers and is interested in developing vocational curricula. For example, he would like to start a school canteen which would yield a profit for the school and offer grade 6 students opportunities to participate in economic transaction and prepare for possible work in or ownership of a trade store or cooperative farming. He is similarly interested in seeing students get training in agriculture and art. He was instrumental in organizing a community vegetable market each Monday, Wednesday, and Friday

where local parents and school children sell vegetables to teachers. Unfortunately for Divanap, J. U. is applying for positions in schools on the Sepik; he, like every other PNG teacher who has been posted at Divanap, feels isolated, uncomfortable, and lonely and wants to leave. It is unlikely, then, that J. U. will implement many of his ideas for bush schools at this bush school.

J. U.'s style is quiet, somewhat formal, 'by the book.' He rarely talks at a class and tends to structure tightly constrained dialogue sequences of question-answer-evaluation. He is not especially fluent in English, and he is also rather quiet, and thus he is not likely to talk extemporaneously about a topic or lead a free-floating discussion. Lessons are structured from Teachers' Guides, although he is apt to prepare his own lesson introductions and final discussions. He also will bring the class back from independent work for an extemporaneous review of lesson material if students are having too much difficulty with the activity. J. U. mostly organizes teacher-directed or independent activities, rarely student pairs or groups. J. U. does use in-class evaluation of student activities as a basis for further instruction or class review. He does not often use evaluation of exercise books or term tests (the only tests administered) to inform his lesson plans and procedures.

Subject Sample

EXPERIMENTAL AND CONTROL CLASSES - DIVANAP

Grade Leval	Years Teach. Exper.	Boys	Girls	Total	Mean Age ($\bar{x}$)
2A (control)	1	24	6	30	9.9
2B	2	25	11	26	11.0
4	7	23	5	28	10.9
6	1	24	9	23	14.6
Total	1.4	76	31	107	$\bar{x}$=11.4

There are many more boys than girls at Divanap. Drop-out rates are evident in decreasing class sizes with increasing grade level. The age at each grade is substantial for both boys and girls.

SUBJECTS ASSESSED - DIVANAP COMMUNITY SCHOOL

Grade Level	PMAT 2	Pre Test	COG	PMAT 3	Post Test
2A (control)	24	(TAS-2) 24	N/A	27	(TAS-1) 27
2B	23	(TAS-2) 22	14	26	(TAS-1) 26
4	28	(TAS-2) 28	18	26	(TAS-1) 27
6	22	(TAS-1) 22	9	22	(TAS-2) 23
TOTAL	97	96	41	101	103

Curriculum Implementation Documentation Problems (Field Notes, Teacher Interviews)

I was able to collect much rich and useful data on curriculum implementation as well as to make practical and concrete suggestions for curriculum revision. Still, it would have been helpful to me to have had more of an in-service prior to research at my site. I have not been trained in maths education, nor have I taught maths though I have taught remedial reading at several primary and elementary levels. Thus the objectives of certain parts of the IMP curriculum were occasionally unclear to me in the field.

Paula Levin's procedure for organizing field notes--Narrative, Summary, Comment--was clear and useful. I would have liked some suggested categories of notes specifically appropriate to the IMP project. I suspect my notes are at times overly detailed on matters not of concern to IMP curriculum implementation. Trialing of the curriculum implementation documentation procedures

in a classroom in the Capital District would have been helpful.

Teacher interviews (pre and debriefings) should have been very useful, but J. U. was shy and reserved and not at all eager to meet with me.

Teacher's Questions and Comments (from Teacher Interviews)

J. U. was a rather quiet and reserved teacher and did not provide me with many questions or comments. For those he did offer, they can be summarized as follows. (1) The directions for teachers in the Teacher's Notes are not always clear.. (2) Some lessons and activities are very difficult for him to understand--particularly games, multiplication with Base-10 materials, division with Base-10 materials, new formats for otherwise familiar tables. He felt these activities required more explanation to both teachers and students. He preferred activities and lessons which, once mastered by the children, had an immediate practical application. Thus he was concerned, for example, that the children learn to count and change money, and he wished there were many more money activities. (4) He liked the sequencing in IMP which he felt was not apparent in MaCS. (5) He felt introductions to a unit are critical and felt that T's Notes should offer suggestions for teacher-directed introductions. Such suggestions should be made flexible, he felt, so that teachers could feel free enough to plan the introduction. (6) He felt there was too much drawing and copying required at all grades, but especially at grade 2. There was also too much materials preparation, especially at grade 4. (7) He liked the activity aspect of the curriculum. He believes children learn through doing.

Teacher's Implementation Problems (from Field Notes)

The teacher frequently was unable to understand the Teacher's Notes. Apparently contributing to his difficulties were: (a) the numbered directions in Teacher's Notes which implied that a teacher could follow them in sequence,

step-by-step, when in fact the notes were more often a cohesive collection of information the teacher needed for any step in the lesson; (b) lack of explanation of the aim of the lesson (which could have helped him to interpret and integrate the notes); (c) inadequate or confusing pictures and diagrams; (d) certain limitations in his style of thinking (somewhat rigid and not well suited to the conceptual nature of the curriculum).

The teacher had consistent difficulty at all grade levels with games and activities in a game-like format. Contributing to his difficulty were: (a) his own lack of familiarity with games; (b) lack of needed clarity in Teacher's Notes regarding distinction between rules of game (how do you play) and objective of the game (what constitutes a win).

The teacher had difficulty in preparing materials at all grade levels, especially at grade 4. Contributing to his difficulty were: (a) his lack of experience preparing materials; (b) lack of needed clarity in Teacher's Notes regarding supplies needed and procedures for materials preparation; (c) lack of needed clarity in Teacher's Notes for use of materials--their purpose in the lesson.

The teacher sometimes had a bit of difficulty arranging to have materials at hand and distributing them when needed. Classes at Divanap are small (23, 26, 28), and I suspect his difficulties would have been substantial with larger classes. Contributing to what difficulty he had were: (a) his lack of experience using class materials; (b) the number of materials needed; (c) lack of clarity in Teacher's Notes regarding number of some material needed for each group of students; (d) lack of needed clarity in Teacher's Notes regarding purpose of materials.

Evaluation of Instructional Activities

Grade 2

Classification: No lessons on classification were taught.

Measurement: The instructional activities for measurement seemed potentially useful but were not entirely successful at Divanap. One lesson required an easy seriation of 2 measurements, others an overly difficult seriation of 5. Teacher's Notes did not adequately stress the discussion and activity aspects of these lessons, and the result was often merely tedious copying for the students. It was not always clear to me the relative importance of children's learning to seriate vs. to represent a seriation. There were many children who could have managed to do and learn from a seriation activity but could not yet represent a seriation. Since this teacher emphasized only the representation in their exercise books, many children learned nothing.

Number Operations: The activities for number operations varied in their effectiveness primarily due to the teacher's variability in successful use of the activities. The teacher had difficulty organizing use of chalk-board, exercise books, groups; he had difficulty organizing Base-10 manipulations, writing numbers on chalk-board, writing numbers in exercise book. In general he did not seem to have mastered (following Moresby in-service) the understanding that concrete manipulations preceded representation of those materials preceded symbolic representation, and he needed reminders and guidance in following sequence as laid out in Teacher's Notes. Activities involving Base-10 regrouping were quite successful as exercises in regrouping but not as exercises in symbolic representation. The addition algorithm was not carried out fully either in Base-10 materials or symbolically, as teacher got these procedures confused with one another. Activities with coins were more successful than those with Base-10 materials, in part because the teacher

enjoyed these more and considered them important for the children.

Grade 4

Classification: Only activities in sorting by two attributes were taught. These were quite successful and quite enjoyable for all. The children appeared to learn to classify by two attributes. The teacher needed some reminder that there were always two relevant attributes (there was a tendency to underdescribe), and Teacher's Notes could be strengthened here; also only the concept of "and" but not "or" came through well. Teacher needed help with 145C, and especially 145D, but once he generally caught on, added the innovation of a 'rubbish bin' for all those cards that did not go to the house. Whether this was ultimately desirable (the rubbish bin contents usually went undescribed), it was fun.

Measurement: No measurement activities were taught.

Number Operations: Fractions were quite successfully taught, and teacher and children did well and enjoyed the lessons. There was an initial tendency for J. U. to omit or fail to emphasize the concept of equity in the sharing activities, and curriculum needs strengthening here. Copying time for paper and pencil activities was a bit tedious, but manageable. For the sharing activities, teacher used available materials (stocks, kaukau) other than the scarce items suggested (bananas); however, inequalities in stick lengths just aren't anything anyone would care to argue over and thus did not help much to motivate the concept of equity.

Lessons on multiplication and division and the one lesson taught on addition (carrying) were taught with mixed success. The 'both-ways rule' was critical to multiplication, yet somehow the teacher did not recognize it as such. This teacher did not have an explicit conceptual understanding of multiplication (including 'lots' and the multiplicative relation of rows and columns)

The curriculum needs strengthening here. Since J. U. was unclear on importance of 'both-ways' rule and the concepts of 'lots' etc., the construction of multiplication table from blocks was a failure. It is necessary for students (and teachers) to understand what a multiplication table represents and how to use one, but there must be more structured activities for this for teachers like J. U. More teacher support and teacher-directed activities are needed.

Grade 6

Number Operations: Many lessons on counting systems were dry and uninteresting. Since this is such rich material, there need to be suggestions for discussion and activity rather than pencil-and-paper exercises. Place-value lessons went generally well, even if for some students they were essentially review. Use of Base-10 materials in grade 6 was resisted by this teacher, and it is thus difficult to evaluate the grade 6 activities associated with them. When Base-10 materials were used in a lesson, students often had difficulty with the activity, primarily because of their unfamiliarity just with the materials and their properties and possibilities; they needed first simply an introduction to the materials (as will all grades as IMP materials are gradually phased into the PNG MaCS curriculum across grades). Games were not as useful as they should have been, as both teacher and students were unfamiliar with games and could not easily recognize game objectives and interpret game procedures. However, games held promise, as students loved them once they mastered them. The subtraction table was very abstract for this group and for the teacher. Addition (palindromes) and subtraction games were probably useful, though neither teacher nor students were familiar with purely 'fun' maths work, and the teacher seemed somewhat disapproving. The students did need addition and subtraction review nonetheless. Multiplication with Base-10 was overwhelmingly unclear to all and thus unsuccessful but holds promise with

improvement in teacher training and Teacher's Notes. Many students did not understand multiplication. Students needed work in understanding what a multiplication table represents and how to use one. More teacher-directed activities are needed.

Evaluation of Teacher's Notes

The Teacher's Notes were difficult for J. U. to understand. The recipe quality (each point of information numbered, as if there was a sequence) of the notes tended to fit his usual style of teaching directly from teacher's guides, and thus he tended not to digest and work through the material as a whole but to expect that he could attend to each point in sequence and all would go well. Game instructions were very difficult indeed for him, as he is not accustomed to playing games. Pictures and diagrams were often misleading for him; at the same time, there were often not enough (appropriate) ones. "Things you need" was often misplaced and inaccurate. Page numbers in Teacher's Notes of course did not correspond to page numbers in students' books (none in grade 2), and he kept getting confused about who had what page. Numbers in notes concerned with problem numbers in student books sometimes did not correspond. J. U. could not easily recognize from the notes which activities were more important, and, when lessons got too long or cumbersome, he made, at times, some counter-productive decisions about what to eliminate. I have made many practical suggestions for revision in a set of Master Notes.

It is critical that both lessons and lesson units be framed, with explanations of objectives and suggestions for appropriate motivators.

Grade 6 needs Teacher's Notes differentiated from student books. I suspect that J. U. felt more tied than ever to line-by-line use of the IMP texts because students had them too.

Evaluation of Learning Aids

Base-10 materials are valuable aids, but it will be important to improve reproduction techniques, especially the precision with which the 1 cm^2 singles are cut. Activities permitting explanation and discussion of the materials are needed at every grade level. Teacher in-service in the model of maths education motivating use of these materials (concrete - representational - symbolic) is essential.

Kina Cards are colourful and useful aids for classification activities. If they are expensive to produce, it would be useful to devise more activities involving their use. It would be helpful to devise activities which mimic at least some 'real-world,' practical activities involving classification and logical thinking.

Coin Materials were extremely successful and were the most enthusiastically received of all IMP materials. The teacher was eager to see students learn to count and change money and wanted to do more with these coins. They have considerable potential for further curriculum development.

Measurement devices: The measurement devices were not used at Divanap (perhaps because I did not conduct an in-service in their use).

Other Learning Aids: Squared paper should be very useful, though this teacher was not always clear on its function nor how to lay out problems on it so there was sufficient room for problem solution. There was a relation between his understanding of the lesson content itself and his understanding of the need for and usefulness of squared paper.

Flash cards were constructed (albeit awkwardly) in one grade 4 lesson and showed great promise. Printed cards would have considerable potential.

The place value cards (6-7) were a great success, and other activities could be devised for them. The children learned from this activity.

Playing cards were also exciting and motivating to the kids and have potential depending on community attitudes towards their use in school.

Lessons Implemented - Divanap Community School

Grade Level	Lesson Codes for Detailed Notes	Detailed Notes	Total Lessons Taught (Summary Notes)
2B	53A, 53I, 55A, 56A; 56E, 57A	6	20
4	144A, 145A, 149A, 149B, 149F (not scheduled for Detailed Notes) 149G, 164A	6 (+1 not scheduled)	18
6	6-1, 6-5, 6-12, 6-13, 6-13, 6-16, 6-17, 6-22, 6-24	9	24

Note: All optional lessons except for 6-23 have Curriculum Implementation summaries and, furthermore, many of my summaries are quite detailed.

Overall Conclusions

There is much rich material in the IMP curriculum, but it will require in-service training in: its underlying model of maths education (critical concepts of maths development), teaching techniques for specific lessons, general procedures for organizing groups and pairs, much teacher practice with all materials, the importance of lesson preparation, game procedures and objectives. Teacher Notes need considerable revision and elaboration; there is an especial need for explanatory frames for lesson units and lessons. Consumable materials would greatly facilitate the success of the grade 2 curriculum; otherwise there should be a reduction in paper-and-pencil activities per se. Printed materials (flash cards, etc.) would greatly reduce teacher preparation time and increase likelihood that materials are made and used appropriately. More teacher-directed activities are needed,

particularly in that these students are weak in maths and teacher is more experienced in teacher-directed lessons. At least at this site, to increase teacher direction and structure in the IMP curriculum (given adequate in-service) would not interfere but only support the activity-centered, manipulative nature of this curriculum.

Language Use

Documentation Difficulties: The categories we defined and the record forms we designed were reasonably clear and easy to use, but I am certain that the five observers interpreted and applied the categories somewhat differently. An initial trial of the system and establishment of reliability among the five observers for the same lesson would certainly have been critical to a systematic study of language use. But as it turned out, my teacher overwhelmingly spoke English in grades 2, 4 and 6. Furthermore, he could not speak tok ples so there were only two languages to document (the students virtually never used tok ples in the classroom, as it was prohibited). The procedures for documenting language use were adequate for describing those few occasions when the teacher switched from English to Pidgin.

Language-Use Lessons - Divanap Community School

Grade Level	Lesson Code	Total
2B	53C, 55B, 56B, 56F, 57B	5
4	144B, 145B, 14[illegible]C	3
6	6-2, 6-6, 6-15, 6-19	4

Summary of Language-use: J. U. overwhelmingly used English in all grades. He could not speak tok ples. Students used English but were rarely required to respond in more than a simple phrase. In grade 2, J. U. occasionally

used Pidgin (1) when addressee(s) did not understand a single critical question or directive, (2) when teacher was a bit frustrated with one student or one group of students who persisted in incorrect activity procedures. Since there was relatively infrequent use of Pidgin, it is not possible to make reasonable inferences about its usefulness in teaching maths. The teacher did appear, on a few occasions, to switch to Pidgin to facilitate comprehension; children then responded, evidence that Pidgin might have been more effective in teaching on those occasions. It is interesting to note that Divanap teachers usually used Pidgin outside the classroom when supervising students in outdoor school work. These students used what seemed a garbled Pidgin and English (tok ples was prohibited anywhere on school grounds). However, children in the Oksapmin area are not otherwise exposed to frequent and widespread use of Pidgin and generally are not fluent Pidgin speakers. Whether they indeed understand Pidgin better than English or in what particular context they might understand Pidgin better than English remains an empirical question following this research.

Classroom Interaction

Documentation Difficulties: Classroom interaction data were the most difficult to collect of all data categories. Required were: audio-taping; moving recorder to judicious locations; on-site recording of speaker/addressee; on-site coding of turn-taking procedures ("teacher structuring") responses to student questions ("student structuring") procedures for evaluation ("teacher evaluation"); on-site recording of a narrative account of context and non-verbal behaviours; later preparing an initial transcript. It was impossible for me to do all this on-site (and I am experienced in recording social interaction!). I found that something got sacrificed each time and that I spent long hours at home on each CLAS lesson. Sometimes my tape recorder remained

poorly located, since I would forget to move it in the flurry of note-taking; often it was impossible to keep up with speakers and addressees, since dialogue was rapid; I quickly gave up on on-site coding of teacher structuring, student structuring, and teacher evaluation and instead coded from the audiotape. There was an unfortunate problem with recording quality with the dictaphone tape recorders supplied, and I quickly switched to making recordings with G. Saxe's or T. Moylan's tape recorders; the dictaphone play-back was adequate, however. The codes that were devised (collaboratively, with substantial input from Karen Johnson) were reasonably clear and useful; however, I am certain that the five observers interpreted and applied them differently. I myself found myself shifting over time in code definitions. For "teacher structuring," if the teacher did not appear to intend to solicit a response (merely paused, for example) and students 'responded,' how should such 'response' be coded?; chorus repetitions needed to be differentiated from chorus answers to questions. For "teacher evaluation," positive evaluation/commendation (e.g. "very good") needed to be differentiated from confirming feedback (e.g. "that's correct"); negative evaluation (e.g. "you're not listening") needed to be differentiated from disconfirming feedback (e.g. "that's not it", "good try, but..."); "teacher redirects evaluation to students" almost always was followed by "teacher evaluation," so what was in some sense one event received two codes. Work needs to be done on these codes and on establishing reliability among two coders before these data can be analyzed and reported.

Audiotaped Classroom Interaction Lessons
Divanap Community School

Grade Level	Lesson Codes	Total
2B	53D, 55C, 56C (tapes available also for 53C, 57B)	3
4	144E, 145C, 149E (tapes available also for 164A)	3
6	6-3, 6-7, 6-9, 6-21 (tapes available also for 6-24)	4

Most of the initial transcripts have been prepared and coded. All have been summarized as CLAS field notes.

Summary of Classroom Interaction: The classroom organization for each lesson was generally teacher-class (Cl) for the lesson introduction, followed by independent work (Ind) on the activity; many lessons had a final teacher-class (Cl) discussion, and many lessons had a mid-lesson teacher-class (Cl) review of activity procedures and concepts. The teacher tended to organize lessons in this way even when the Teacher's Notes specified pairs or groups. It was necessary for me to encourage, sometimes prod, him to organize groups, especially to make the function and advantage of groups clear to him. Although he sometimes organized and supervised groups with substantial success, where future lessons in a unit did not seem to really require group experience, he would still tend to eliminate groups, apparently considering them overly time-consuming. When groups were organized, the teacher walked about and supervised fairly effectively, calling the class back for a teacher-class review if he found frequent problems. He tended to organize groups of 6 or 7 (the desks in his own classroom were clustered for groups of 6 or 7), which were generally too large to optimize discussion and participation. Especially for students not used to groups, pairs or groups of 3 or 4 would be preferable, even though it would require more teacher effort when supervising.

Classroom discourse was largely teacher-structured dialogue. J. U. rarely talked at the class. Generally he structured sequences of constrained questions, answers, evaluations. When initiating a topic, he commonly structured participation by nominating one of several volunteers. Once the dialogue had progressed, he might (but rarely) call on students; to close the topic, he generally had the class answer his questions in chorus (chorus answers - not chorus repetitions). In evaluating student responses, he

overwhelmingly evaluated positively (although these evaluations can be better described as confirmation--e.g. "that's correct," then commendation--e.g. "that's good"); late in a topic cycle he might have the class evaluate a student's response and then confirm to all that they were correct. Students almost never asked the teacher any questions, although when they did, the teacher responded.

The teacher did evaluate the student's performance in instructional activities and use this to make decisions about the need for further teaching or review within a class period. But with regard to evaluation beyond the CLAS data, he was not commonly observed to make changes in lesson planning on the basis of performance in exercise books. He graded exercise books once every one to two weeks in order to add to each student's cumulative term record in each subject; class rankings derived from these cumulative scores were publically displayed, presumably to reward good students and motivate slower students. He did initiate on certain occasions after-school lessons, especially for grade 2, in which he would either review a lesson that went poorly or introduce a new lesson he anticipated would go poorly (he felt grade 2 required extensive introduction). After-school lessons were a great deal of work and, understandably, he did not teach after school consistently. Term tests were evidently constructed and administered in each subject each term but never during our stay. Scores did not appear to be used to inform lesson planning but rather to rank students' term performances.

Student Interviews

Difficulties in Conducting Interviews: An in-service training in the IMP curriculum, particularly those lessons pegged for student interviews, would have facilitated breadth and depth of my student interviews. A list for each student interview lesson of questions minimally required by each of

the five observers, with suggestions for further clinical exploration, would have facilitated comparative analysis.

Student Interview Lessons - Divanap Community School

Grade Level	Lesson Codes	Total
2B	53E, 55D, 56D	3
4	144F, 145D, 149D	3
6	6-4, 6-8, 6-10, 6-20	4

Summary of Student Interviews: Two students were interviewed at each grade level, usually a top and bottom student. The students' performance in the interviews commonly reflected the teacher's successes and difficulties in teaching the lesson. Where the teacher had had particular difficulty, I generally attempted to assess what the student did understand and then teach aspects of the lesson. The interviews progressed clinically. My interviews were generally brief and probably do not represent a strength in my notes.

SUMMARY AND CONCLUSIONS

Divanap Community School is situated among the Oksapmin in an isolated highlands region of West Sepik Province. The site can be reached only by single-engine aircraft flight to Tekin mission or Oksapmin government station and then by foot. Missionary and government contact has resulted in changes in religious and initiation practices, agricultural techniques, health care, and schooling, but many aspects of traditional life remain. Almost everyone gardens using slash-and-burn techniques. They grow primarily kaukau and taro, although the didimen have been successfully introducing a variety of vegetables and peanuts and soybeans, both for local consumption and for sale to Tekin mission vegetable market (2 hours' walk) or their own co-operative vegetable

at Oksapmin (4 hours' walk). Many people raise a few pigs as well. There is a growing western influence on Oksapmin culture. Money has filtered through the area, and growing numbers of people handle small amounts. More and more people wear at least one article of (used) western clothing. Many prize western articles including axes, razor blades, and soap. Pidgin is used by some in the area but only when necessary, and many do not speak Pidgin at all.

Divanap school was opened in July 1973. It was built largely of local materials. Despite ongoing work (mostly by students) on school grounds, classrooms, teachers' houses, and gardens, conditions are poor, and, with but three exceptions, no teacher has spent more than one year at the school. There are strains between teachers and the community. Even by 1974, it was difficult to get parents to work on the school voluntarily, and today much work is done by the school children. Yearly grade 1 intake enrollment peaked in 1975 and, while lower, has remained fairly stable since then. The ages in grade 1 have ranged from 7 to 14. Boys enroll and remain in school at markedly higher rates than girls, but enrollments and retention rates even for boys are not high. Despite this kind of record, it was our impression that the school does have some support from the community, and many parents and students recognize it as virtually the only avenue through which the area can begin to join the larger highlands community.

The IMP curriculum materials were not uniformly successful at this site, but failures appeared to be due as much or more to the particular teacher who used them than to any characteristics of the Divanap children as learners. Despite an excited interest in IMP, J. U. remained rather inflexibly tied to his own math algorithms and teaching practices. J. U. had difficulty with number operations in particular, and I attribute some of this difficulty to a lack of understanding of the model of maths teaching/learning (concrete,

representational, symbolic) underlying the entire IMP curriculum. J. U. was moderately successful with number operations lessons on money, somewhat successful on measurement activities, quite successful on fractions and on classification by two attributes; one thing in common among these was his perception that these lessons had practical value for the children (he interpreted the classification lessons as lessons in map reading). It seemed that his perception of practical utility helped him define objectives both for himself and for students, and thus something got done and learned. He was, then, frustrated by and sometimes outrightly disapproving of exercises that were concerned just (as he saw it) with reflections on acquired maths knowledge (e.g. grade 6 10x10 subtraction table), abstract concepts (e.g. negative numbers), or "fun" maths exercises (e.g. palindromes, regrouping in 3's). Somewhat paradoxically he approved of games as motivators, believing that children learn by doing; unfortunately he had consistent difficulty interpreting game rules (at his request, I taught most of the game lessons). He claimed that he thought maths groups were important to learning, but I had to encourage and even prod him to organize these. The children's interest in the IMP curriculum tended to mirror J. U.'s success in implementing it. But in general they were excited to have books and materials. Some bright students went beyond J. U.'s teaching and worked independently with the materials, inventing their own algorithms or game rules. On those occasions where J. U.'s teaching went well or I assisted or a bright peer assisted, less bright students became just as involved. (Further evaluation of the IMP curriculum follows shortly.)

Language used in classrooms was overwhelmingly English. Students were prohibited from using tok ples anywhere on school grounds. J. U. used Pidgin on rare occasion when frustrated in teaching; students still responded in

English. J. U. was not comfortably fluent in English and perhaps in part on that account did not engage students in unstructured discussion; students were rarely required to contribute more than a phrase in response to a constrained question. The classroom organization for each lesson was generally teacher-class for the lesson introduction, followed by independent work on the activity; many lessons had a final teacher-class review. Groups were organized primarily at my encouragement; although the groups of 6 or 7 were too large to be really effective, J. U. was nonetheless fairly effective in supervising them. Classroom discourse was largely teacher-structured dialogue, organized so that respondees rarely erred; evaluations were overwhelmingly confirmations of correct answers. In class J. U. was sensitive to class difficulties and lengthened introductions or initiated mid-activity reviews when concepts and procedures were unclear to many students. Sometimes he also held additional lessons after school after or in anticipation of a difficult class. While J. U. periodically checked exercise books (every 1-2 weeks), he did not use this information to inform lesson planning; exercise books were scored in order to rank students on their cumulative term performance and thus, presumably, to motivate them to work harder. Term tests were apparently constructed and given each term but not during our stay; again, these scores were used just for class rankings.

The following are recommendations for improving IMP materials, pedagogy, and teacher training so that they are most useful to and <u>used</u> <u>by</u> teachers like J. U. at sites like Divanap. The Base-10 materials hold promise providing that they are cut with greater precision (e.g. so that 10 $1cm^2$ indeed match 1 10cm rod) and provision is made for adequate introduction to these materials across grades as the materials are being phased in. Materials with practical application--for example, the Base-10 money--may hold especial promise at an

isolated site where both students and teachers perceive competence with these as important to community development. Some materials which were to be class or teacher constructed (like flash cards) may be better mass-produced, at least at an isolated site where persons have little knowledge of academic aids to help them follow instructions for preparation. Consumable materials, especially for grades 1 and 2, are absolutely necessary to the success of the curriculum. More lessons which are merely activities or discussions without daily paper-and-pencil independent exercises are needed. These activities, like the materials, may be more successful at an isolated site like Divanap if they are analogous to real-world activities students want to develop skills for; dice and card games were quite successful (once I helped with rules) in part, I think, because students were becoming aware of their importance to certain more 'progressive' adults in the community. Maths groups are critical but should be no bigger than 3 or 4 students. Teacher's Notes must be revised so that the objectives of the lesson are made clear, appropriate motivators are suggested, and the concepts and algorithms to be taught are distinguished from the suggested steps a teacher might take in teaching the lesson; only items which truly have a sequential relation to one another should be numbered. Both lessons and lesson units should be framed for teachers. In the Notes and in teacher training, the goals of the curriculum designs should be shared with the teachers. The underlying model of maths development (concrete, representational, symbolic) must be clear; understanding the model should greatly help teachers interpret and follow curriculum sequencing. Teacher training will be critical to the success of the curriculum; this curriculum teaches concepts (e.g. the principles underlying subtraction and multiplication tables) while teachers themselves have been taught only skills; if teachers are to succeed at IMP teaching, they will in part have to unlearn

or relearn their own approach to mathematics.

IMP materials hold promise for Divanap. But what were the children learning? J. U.'s concern with immediate practical application of maths learning bears further consideration for a site as isolated as Divanap; this curriculum, like so many things the Divanap children were asked to learn in school, had little application to most tasks posed them in daily life. Still, they worked consistently hard in class to learn these new maths; indeed, they may well upon retesting retain well what they have learned. Yet, regardless of the success of this curriculum as measured by student involvement and learning to do IMP activities, i.e. school learning, it is my intuition that there may be problems of long-term retention and application of IMP maths where a culture does not require knowledge like that developed through the IMP curriculum. For maths education in a community school like Divanap, the IMP curriculum could include suggestions for additional or alternative activities both in and out of the classroom--like markets or canteens or new agricultural techniques--for which application of new maths skills are required. If students and teachers (at least in isolated sites) view community development as the essential motivation for primary school education, then recognition of their view in the form of a more immediately practical curriculum may ensure the curriculum's success.

INDIGENOUS MATHEMATICS PROJECT

WORKING PAPER SERIES

1. Learning to Compute.
   R. Souviney, January 1980.

2. Strategies for Mathematical Problem Solving.
   R. Souviney, March 1980.

3. Assessment Administration Guide.
   R. Souviney, April 1980.

4. Field Guide for Documenting Classroom Events and Community Environment.
   P. Levin, M. Gearhart and R. Souviney, June 1980.

5. International Congress on Mathematics Education.
   R. Souviney, V. Kada and D. Malaga; D. Lancy; M. Britt; B. Roberts, August 1980.

6. Andra Community School Field Report.
   P. Levin, November 1980.

7. Ororo Community School Field Report.
   J. Lineberger, November 1980.

8. Divanap Community School Field Report.
   M. Gearhart, November 1980.

9. Kero Community School Field Report.
   K. Johnson, November 1980.

10. Muglamp Community School Field Report.
    B. Rowe, November 1980.

11. Teachers Notes and Student Worksheets – Grade 2. 1980.

12. Teachers Notes and Student Worksheets – Grade 4. 1980.

13. Teachers and Students Text – Grade 6. 1980.

14. The Changing Form of Numerical Reasoning Among the Oksapmin.
    G. Saxe, January 1981.